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A THREE-YEAR FISHERY INVESTIGATION, FORT PECK RESERVOIR, MONTANA, 1948-1950.

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A THREE-YEAR FISHERY INVESTIGATION

FORT PECK RESERVOIR

MONTANA

1948-1950

Report Prepared by Missouri River Basin
Studies, Fish and Wildlife Service

Billings, Montana

April 17, 1952

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
MISSOURI RIVER BASIN STUDIES
Billings, Montana

A THREE-YEAR FISHERY INVESTIGATION

FORT PECK RESERVOIR

MONTANA

1948-1950[1]/

March 27, 1952

1/ Report prepared by the staff of the Office of Missouri River Basin Studies, Fish and Wildlife Service, Billings, Montana

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Nat. Hist. Survey

MRBS 816

Six channel catfish and one drum taken at Snow Creek, Fort Peck Reservoir, July 4, 1948. (Photograph by Wayne Ashcraft).

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INTRODUCTION

A creel census was conducted on Fort Peck Reservoir, Montana, in 1948, 1949 and 1950 by the Missouri River Basin Studies, Fish and Wildlife Service, as part of a general program designed to provide information on the utilization and yield of representative bodies of water associated with water-use projects. Fort Peck Reservoir is an example of a large, on-stream reservoir with extensive drawdowns. Although primary consideration was given to determination of the utilization, yield, and fisherman expenditures at the reservoir and the reach of stream immediately below Fort Peck Dam, limited information was secured on various other factors influencing the fisheries. However, the present report is concerned primarily with creel census data and fisherman expenditures.

Acknowledgment is made of services and assistance rendered during the course of the study by Montana State College, Montana Fish and Game Commission, Montana State Park Commission, U. S. Geological Survey and the U. S. Corps of Engineers.

DESCRIPTION

Fort Peck Reservoir is located on the Missouri River in Northeastern Montana in McCone, Valley, Garfield, Phillips, Petroleum, and Fergus Counties (see map). The dam is located at mile 1,868 on the Missouri River, 18 miles south of Glasgow, Montana.

The reservoir was built by the U. S. Corps of Engineers to provide storage of water for navigation and flood control downstream on the Missouri River, and for irrigation and production of hydroelectric power. Construction of the dam was started in 1934. The gates were closed and the reservoir started to fill in 1939.

Although the maximum operational level (2,250 feet m.s.l.) was not reached during the course of the study, the reservoir will have a surface area of 245,000 acres at maximum level. The reservoir extends upstream about 110 airline miles, has a maximum clear width of 16 miles, and a shoreline of about 1,600 miles. The greatest depth at maximum pool level is approximately 225 feet. The reservoir is irregular in shape. Except for one rather large arm extending about 40 miles up Big Dry Creek at the southeast end of the reservoir, it generally covers a narrow area along the old Missouri River channel. There are numerous small, intermittent tributaries which empty directly into the reservoir, but aside from the Missouri River itself, the Musselshell River is the only important stream flowing into the reservoir.

Fort Peck Dam is an earth-filled structure about 250 feet high and 21,000 feet long, with a maximum width of 4,900 feet at the base and 100 feet at the top. Field boulders and quarry stone, blanketed with an 18-inch layer of gravel, were superimposed on the upper upstream face of the dam to protect it from wave action; the gravel provides the only suitable spawning sites in the reservoir for salmonids.

Water levels in the Fort Peck Reservoir fluctuated about 21 feet in 1948, 18 feet in 1949, and 20 feet in 1950. The maximum level attained in 1948, about elevation 2,244 feet m.s.l., was reached in mid-July, from which time the water was gradually lowered until the minimum level, elevation 2,223 feet, was reached in December. In 1949, the maximum and minimum elevations were 2,232 feet, reached in early July,

and 2,214 feet in October, respectively. In 1950, the maximum and minimum levels were 2,234 feet in July and 2,214 feet in January. The maximum recorded inflow to Fort Peck Reservoir from the Missouri River is about 63,000 second-feet; the minimum recorded inflow about 1,200 second-feet.

Subsurface outlets and a spillway are provided for outflow from the reservoir. Four tunnels, each with an inside diameter of 24 feet 8 inches, over a mile in length, and lined with reinforced concrete are located under the east abutment of the dam. Flow through the tunnel is regulated for the production of power. The spillway is designed to discharge a maximum of 250,000 second-feet and is located in a natural flowage-way in the rim of the reservoir three miles east of the dam. It consists of a partially lined approach channel, a reinforced concrete gate structure, and a mile-long, reinforced, concrete-lined, discharge channel.

Analyses of water samples from Fort Peck Reservoir (Appendix A) indicate moderate hardness, with the sulfates and bicarbonates of sodium, calcium, and potassium predominating in the dissolved components. The pH factor indicates that the water is slightly alkaline and entirely suitable in this respect for the fishes found therein. The dissolved oxygen content of the water was found to be adequate at all times. Adverse conditions resulting from domestic or industrial pollution were not apparent.

The deeper water of the reservoir is usually clear, although in the small, shallow bays and along the shore it is often quite murky

due to wave action on the erodable shore[1/] (Fig. 1). Sedimentation surveys are being made in the reservoir by the Corps of Engineers, but results are not available at this time.

Maximum surface-water temperatures recorded in the reservoir adjacent to the dam during the study were about 75° F. Bottom-water temperatures taken in the same general area, during the period of maximum surface water temperatures, reached a minimum of about 45° F. Maximum and minimum water temperatures at the penstock, as recorded by the Corps of Engineers for the three-year period of study were 53° F., and 34° F., in 1948; 59° F., and 34° F. in 1949; and 57° F., and 33° F., in 1950.

Phenicie (1950) stated that, "there evidently was no thermal stratification of thermocline magnitude over the reservoir as a whole, although on July 13, 1949, thermoclines were noted at a few stations." A later study made by the Fish and Wildlife Service on September 13, 1950, indicated that both thermal and gaseous stratification occurred in Fort Peck Reservoir at that time. It is apparent that in a reservoir of this type, complex and varied thermal patterns may be present, although additional studies would be required to determine their extent and character.

Vascular aquatic vegetation has not yet become established in the reservoir, although at certain periods during the summer, plankton blooms were noted in some of the small isolated bays. Timber and brush

1/ Fort Peck Reservoir is almost completely surrounded by outcroppings of Bear Paw Shale, a soft, erodable, shale formation of the Cretaceous Period. Although this shale is covered with a thin layer of glacial till there is little soil development and the growth of native vegetation is limited; consequently, erosion is severe.

left standing along the edge of the river and in the coulees at the time of construction have now died and stand as snags (Fig. 1).

Since no extensive work has been done on determining the extent of the success of natural reproduction, no definite conclusions can be made at this time. It is believed that fluctuations in water level in the reservoir (about 20 feet annually) and the generally prevailing low water temperatures below the dam are not conducive to natural reproduction. It also appears that trout and salmon are handicapped due to the lack of extensive suitable spawning grounds.

Fish predators are not of importance to the Fort Peck fishery, although large flocks of white pelicans are present both on the reservoir and below the dam during most of the summer.

The climate in the vicinity of Fort Peck is typical of the Great Plains, having widely varying temperature extremes and generally scanty rainfall. At Glasgow, the average January temperature is 9.0° F.; the July average is 70.7° F. Extreme temperatures range from 113° F. to minus 59° F. Precipitation averages about 13 inches per year, 69 percent of which falls between May and September. The average length of the growing season is 123 days, but varies widely from year to year. High to moderately high winds prevail throughout most of the year.

Wheat farming and stock raising are the chief occupation in the rural areas near Fort Peck Reservoir. The town of Fort Peck, with a population of 1,191 (Jan. 1951), was developed as the result of construction and maintenance activities connected with Fort Peck Dam. Wolf Point, with a population of 2,547, is the county seat of Roosevelt County and is located 50 miles east of Fort Peck. Glasgow, with a

population of 3,810 is the county seat of Valley County and is located about 20 miles northwest of the town of Fort Peck. Nashua, a town with a population of about 950, is located 12 miles north of Fort Peck. The three counties surrounding the lower end of the reservoir (Valley, McCone, and Garfield), or that portion most heavily utilized, have a population of only about 1.3 persons per square mile of land area (1950 census).

Generally speaking, only the area immediately surrounding Fort Peck Dam is readily accessible to fishermen. Several outlying areas on the reservoir are accessible by automobile, but the approaches to these areas are over roads which are rough when dry and virtually impassable when wet. The main points of access on the north side of the reservoir are at the Dam and Dike. The Pines, Bear Creek, and Timber Creek, Rock Creek, Hell Creek, Snow Creek, Box Creek, Devil's Creek, and the mouth of the Musselshell River are the main fishing sites that can be reached from the east and south sides of the reservoir (see map).

The Corps of Engineers has developed recreational sites at The Pines, Hell Creek, Rock Creek, Devil's Creek, Bear Creek, and in the vicinity of the dam. These recreational developments consist of shelter buildings, picnic tables, indoor cooking facilities, outdoor fireplaces, bath houses, and sanitary facilities. Development also includes improvement of access roads. Tentative plans call for similar developments at Box Creek, Snow Creek, and Wilder Crossing. A new state highway linking U. S. Highway 2 with State Highway 18 and extending south from Malta has been proposed, which would enable traffic to cross

at the upper limit of the reservoir in the vicinity of Wilder Crossing and thus make this area readily available.

A few cabins and docks have been built by private parties in the vicinity of the dam and at Rock Creek. A privately-owned fishing camp was maintained at Rock Creek where boats and motors could be hired, cabins rented, and live-bait purchased. Boats, motors, and live bait are available in the vicinity of the dam.

A variety of fishes occur in both the reservoir and the Missouri River below Fort Peck Dam. It is possible that other species occur in the reservoir in addition to those listed in Table 1. Although carp composed less than 1 percent of the fish in the creels checked and were rarely taken during gill netting operations, this species is known to be quite abundant in the reservoir. During the summer months carp could be seen in large schools in the small shallow bays in the reservoir.

History and Management of the Fishery

Prior to the creation of Fort Peck Reservoir there was relatively little fishing in that portion of the Missouri River later flooded by the reservoir. Since 1939 there has been a steady increase in fishing. Horn (1947) stated that for a few years following closure of the gates in 1939, heavy concentrations of sauger, carp, and catfish furnished excellent fishing immediately below the dam. Extensive fishing began in the reservoir in 1942, when yellow perch were caught in large numbers. Black crappie and rainbow trout were caught in limited numbers beginning in 1942. Records kept by Mr. Horn indicate that about 150,000 fish were taken each year in 1945 and 1946 in the area adjacent to Fort Peck Dam.

Table 1. Partial list of fishes recorded from Fort Peck Reservoir and adjacent waters, Montana, 1948-1950[1]

Species	Location	
	Reservoir	Missouri River below dam
Paddle fish (Polyodon spathula)	x	x
Shovelnose sturgeon (Scaphirhynchus platorynchus)	x	x
Shortnose gar (Lepisosteus platostomus)		x[2]
Goldeye (Amphiodon alosoides)	x	x
Brown trout (Salmo trutta)	x	x
Rainbow trout (Salmo gairdnerii)	x	x
Carpsucker (Carpiodes carpio)	x[2]	x[2]
Bigmouth buffalo (Megastomatobus cyprinella)	x[2]	x[2]
Smallmouth buffalo (Ictiobus bubalus)	x[2]	x[2]
Blue sucker (Cycleptus elongatus)	x	x
Mountain sucker (Pantosteus jordani)	x	x
Carp (Cyprinus carpio)	x	x
Flathead chub (Platygobio gracilis)	x	x
Lake chub (Couesius plumbeus)	x[2]	
Black bullhead (Ameiurus melas)	x	
Channel catfish (Ictalurus lacustris)	x	x
Stonecat (Noturus flavus)		x[2]
Yellow perch (Perca flavescens)	x	x
Sauger (Stizostedion canadense)	x	x
Iowa darter (Poecilichthys exilis)	x[2]	
Black crappie (Pomoxis nigra-maculatus)	x	x
Freshwater drum (Aplodinotus grunniens)	x	x
Burbot (Lota lota)	x	
Lake trout (Cristivomer namaycush)	x	x
Largemouth black bass (Micropterus salmoides)		x
Kokanee (Oncorhynchus nerka kennerlyi)	x	x
Yellow pikeperch (Stizostedion vitreum vitreum)	x	x

1/ After Phenicie (1950) in part. Many minnows taken during netting operations are not included here.

2/ Taken in nets only; all other species occurred in creels.

To date, management of the Fort Peck Fishery has consisted of periodic stocking and enforcement of regulations. Unfortunately, the history of fish planting in Fort Peck Reservoir is not complete. Many plantings for which there are no official records have been made

by individuals. Horn (1947) canvassed the community near Fort Peck and learned that an indeterminate number of yellow perch were planted in 1938 and again in 1940. He also reports a planting of 3,000 three- and four-inch crappie in 1940. His records indicate that 155,000 kokanee (blueback salmon) were stocked between 1940 and 1947. Fish planted by the U. S. Fish and Wildlife Service and the Montana Fish and Game Commission since establishment of the reservoir are recorded in Table 2.

Sport fishing is permitted the year around in the Missouri River and Fort Peck Reservoir, except for areas near the powerhouse and spillway which are closed to fishing as a safety measure. In 1950, the area immediately adjacent to the emergency shaft houses was closed for security reasons. The daily limit of all species of trout and salmon was 15 fish, not to exceed 10 pounds and 1 fish. The daily limit for sauger and yellow pikeperch was 15 fish, not to exceed 15 pounds and 1 fish. In 1948, a total of 50 perch, crappie, sunfish, bluegill, and bullheads could be taken in one day. In 1949 and 1950, the daily bag limit on the latter fishes was removed. There was no daily bag limit for all other species of fish. The possession limit for all fishes was one day's legal catch. The hours of fishing were from 5:00 a.m. to 9:30 p.m. Set-line fishing for non-game species was allowed in the reservoir.

METHODS

When Fort Peck Reservoir was constructed, a new and extensive fishery was created in waters immediately below Fort Peck Dam as well as in the reservoir itself. Equal consideration was given to the two fisheries thus created during all three years of study.

Table 2. Recorded plantings of fish, Fort Peck Reservoir, Montana, 1941 through 1950

Species	Size	Numbers1/							
		1941	1942	1943	1945	1946	1947	1949	1950
Rainbow trout	Fry		625.0	105.0					
	4½"-6"		10.0			4.2		8.4	
Brown trout	Fry					55.0			
	2"-2½" 5½"				40.0	6.24		1.68	2.7
Kokanee	Fry					55.0		56.0	57.0
Largemouth black bass	Fgl.	4.0		19.0	25.46				
Bluegill	Fgl.								
	Yrl.				1.5	8.5	52.9		
Black crappie	Fgl.	4.32				144.7	13.1		
Bullhead	Fgl.					49.7	3.7		
Pike	9"								2.2
Yellow pikeperch	Fry					1000.0			
Brook trout	Fry								2.0
Cutthroat trout	Fry								56.0

1/ In thousands of fish

Because of differences in intensity of use and composition and rates of catch, and in order to facilitate the collection of data, the reservoir was divided into two areas: Adjacent to the Dam, and Outlying Areas. The Area Adjacent to the Dam included about 15 miles of shoreline extending from Duck Creek (four miles west of the town of Fort Peck) eastward across the dam to and including the channel leading to the spillway structure. This area was further subdivided into check areas as follows: Upper Spillway, Points East (between the spillway and the emergency shaft houses), the Dam and Dike, Recreation Area, Snob Hill, and Duck Creek (see map). Limited fishing occurred at all the outlying areas previously listed (p. 6), but creel checks were made only at Rock Creek, The Pines, Hell Creek, Snow Creek, Timber Creek, aerial check (1948 only), and Bear Creek (1950 only), as it was believed data obtained from these areas would be representative of fishing at other outlying areas. The Area below the Dam included in the creel census consisted of the Tunnel Area, a one-mile reach of the river immediately below the power plant; the Borrow Pits (not censused in 1950), a 1,500 acre area adjacent to the river which was excavated during the construction period; and the Lower Spillway, from the base of the spillway apron to the confluence of the spillway channel with the Missouri River, a distance of about two miles.

Except for slight modifications as the occasion demanded, the creel census was conducted daily at all locations except the Outlying Areas during the following periods: May 4 through September 14, 1948; June 12 through September 14, 1949; and April 16 through September 16, 1950. In addition five off-season checks were made in both 1949 and 1950 as

follows: January 18-24, 1949 (7 days); March 3-10, 1949 (7 days); April 19-25, 1949 (7 days); October 22-30, 1949 (9 days); January 12-19, 1950 (8 days); February 17-23, 1950 (7 days); October 22-28, 1950 (7 days); November 16-19, 1950 (4 days); and December 8-11, 1950 (4 days). Rock Creek, The Pines, Hell Creek, Snow Creek, and Bear Creek (in 1950) were checked with the aid of a 26-foot Higgins Cruiser collectively a total of 13 weekdays and 41 Saturdays, Sundays, and holidays between July 1 and September 12, 1948; 96 weekdays and 33 week-end days and holidays between June 2 and September 14, 1949; and 91 weekdays and 58 week-end days and holidays between June 1 and September 16, 1950.

Although an effort was made during the study to contact as many fishermen as possible who were through fishing for the day, it was necessary to contact about 25 percent of the fishermen before they were through fishing. Estimates for the additional hours fished and additional number of fish caught by this latter group of fishermen were based upon data collected for those anglers who were through fishing.

In addition to the number of parties contacted, some parties were recorded which were seen but for various reasons not contacted. A small number of parties were undoubtedly missed entirely. In 1948 and 1949, the number of parties in the latter group was estimated to be 5 percent of the total estimated number of parties. In 1950, day to day estimates indicated that this amounted to about 9 percent.

During the main census periods of 1948, 1949, and 1950, approximately 67 percent, 58 percent, and 38 percent, respectively, of the total number of fishing parties utilizing the censused areas of the reservoir adjacent to the dam were contacted. During the off-season

periods in 1949 and 1950, 10 percent and 7 percent, respectively, of the parties using the areas were checked. However, since only 19 percent of the total estimated utilization in 1949 and 13 percent in 1950 occurred during the off-season periods, the low percentage of contacts during these periods of the year would not appreciably affect the annual estimates of utilization.

During the main census periods of 1948, 1949, and 1950, about 85 percent, 71 percent, and 53 percent, respectively, of all fishing parties utilizing the areas checked below the dam were contacted. During the off-season periods in 1949 and 1950, 11 percent and 6 percent of the total parties were checked. As in the case of the reservoir area adjacent to the dam the low percentage of contacts in the off-season period would not appreciably affect the validity of the total annual estimates. Only 27 percent of the total estimated utilization below the dam in 1949 and 15 percent in 1950 occurred during the off-season periods.

Except for the off-season periods, estimates of utilization and yield were made on a weekly basis for the area of the reservoir adjacent to the dam for the area below the dam. Although creel census data were used in arriving at estimates of utilization and yield for seasons of the year other than the main census periods, information obtained from local fishermen, weather conditions prevailing before and after each creel census period, and other factors were given due consideration. No off-season checks were made in 1948; however, estimates of utilization and yield for the periods prior to and subsequent to the census period of May 4 to September 14 have been included in the subsequent

discussions. These estimates were determined by proportional means, using as a basis annual estimates for 1949 and 1950 and 1948 summer estimates, all of which were based on creel data.

Since only periodic checks were made of the outlying areas, it was not possible to determine total utilization and yield in the same manner as for the area adjacent to the dam and the area below the dam. Estimates of total utilization were derived by determining the average number of fisherman-days for both weekdays and week-end and holiday days, and multiplying these by the total number of days in each category. Yield in numbers of fish was obtained by multiplication of the derived total number of fisherman-days by the average catch per fisherman-day. The percentage distribution of the various species taken at outlying areas was applied to the total catch and the resulting numbers were multiplied by the average weight of the appropriate species to arrive at estimated total weight. Aerial flights over all outlying areas in 1948 and 1949 revealed little fishing activity except at areas checked by boat, thus it was assumed that estimates made for the areas checked approximated that for the entire reservoir other than for the area adjacent to the dam. In considering utilization and catch at the censused outlying areas for the entire year, it was further assumed that average figures obtained during the check periods were applicable for the period May 15 through October 31 each year. Interviews with game wardens, sportsmen, and personnel of the Corps of Engineers indicate that fishing at the outlying areas is confined almost entirely to this period. Partial attendance records kept by Montana Park Commission caretakers at Rock Creek and Hell Creek in 1949 and 1950 indicate that

the average figures obtained during the check period were not fully applicable to early and late season fishing at outlying areas; nevertheless, figures obtained were applied for the period May 15 through October 31 in the belief that the exaggerated estimates thus obtained for the areas checked would compensate for utilization and yield at areas not checked.

Weights and lengths of fish (Fig. 2) were secured during the course of the creel census from representative samples of the creels checked. Estimated weights used in this report are based upon average weights obtained from these data.

The term "party" as used throughout this report, represents a group of fishermen who traveled together on a fishing trip. Utilization is expressed in terms of fisherman-days and pole-hours. A fisherman-day represents a day's fishing by a single fisherman, irrespective of the number of hours involved. Hours of fishing effort by one angler using one fishing pole is represented by the term pole-hours. Hours of fishing with set lines in the outlying areas were considered as pole-hours. When sportsman expenditure studies were initiated in 1948, an attempt was made to secure data on original investments in equipment; annual expenditures for licenses, contributions, and similar items; as well as on trip and transportation expenditures. The form devised for this purpose was lengthy; consequently, it was decided to secure the information from only one individual out of every twenty-fifth party contacted for creel census data. Because of unforeseen difficulties, data were secured from only 108 individuals, or less than 1 percent of the 12,839 fishermen contacted for creel census. Since there were 237

fishermen in the 108 parties from which expenditure data were secured, and all members of the party were considered in determining mileage, transportation expenditures were based on an approximate 2 percent sample. As a basis for later computations relating to investment expenditures, the interviewee was asked to give the original cost of equipment, life expectancy, the number of times the equipment was used annually, the number of persons using the equipment, and cost of maintenance.

The form and procedures were modified somewhat in 1949. To alleviate a few of the difficulties encountered in 1948, the replacement cost of equipment was substituted for original cost and cost of maintenance. The question on life expectancy was eliminated on the thesis that it could be more easily determined in other ways. The form was further modified to provide for entries for each member of a party. The procedure was modified to provide for an expenditure interview with each member of every tenth party. In 1949, 10,077 fishermen were interviewed for creel data, but only 708 individuals (340 parties) were quizzed relative to expenditures for fishing. Although the 1949 economic survey was intended to be a ten percent coverage of all creel contacts, the 708 individuals represent only about 7 percent of all fishermen contacted.

Procedures were further modified in 1950. Expenditure data were obtained from all parties contacted. This was possible because of the elimination of time-consuming questions on annual and investment expenditures. Annual and investment expenditures were to be secured separately from a representative sample of license holders. Trip expenditures were obtained on the basis of the expenditure per party

per day. Mileage was also obtained on a party basis as part of the creel census survey.

For convenience in compilation and analysis, expenditure data for all three years were separated into four general categories as follows: (1) Expenditures for transportation; (2) Trip expenditures (exclusive of transportation) for food, lodging, bait, rentals, and miscellaneous items such as beverages, film, and similar items; (3) Investments in equipment (including operation or maintenance costs in 1948 only) and (4) Annual expenditures for such items as fishing licenses and club fees.

Determining the investment in equipment presented the greatest difficulty in 1948 and 1949, both in securing accurate answers from the fishermen and in computing the details. Investment items included were: boats, motors, trailers, sleeping bags, tents, camping equipment, special clothing, rods, reels, and other fishing tackle. In 1948, the original value of equipment divided by the life expectancy plus annual maintenance, divided by the number of times the equipment was used per year, divided by the number of persons using the equipment, resulted in the investment expenditure per day.

In 1949, the replacement value of equipment was used in calculating the investment expenditure. Since the value of the equipment was based on the cost of replacement, rather than on resale value at the time of the interview, the maintenance cost could be considered as covered.

The number of times each piece of equipment (or fishing license) was used annually is essential in computing annual and investment expenditures on a per-day basis. However, only 29 of the 108 individuals in

1948 and 42 of the 708 individuals interviewed in 1949 provided usage data. A standard average annual usage figure of 25 was adopted and applied in the case of those individuals who did not provide information on usage. This figure of 25 was based on the average annual usage obtained from the individuals in 1948 and 1949 who provided usage data. Some equipment in the 1949 data was not identified, and because of the impossibility of assigning a life expectancy figure, no attempt was made to assign a usage figure to this equipment. Thus, a small undeterminable expenditure had to be excluded from the total per-day investment expenditure figure derived for 1949 and, consequently, the results somewhat underestimate the true expenditures.

Transportation and trip expenditures were determined in a similar manner during all three years of the study. The round-trip mileage traveled by each party contacted was divided by the number of days in the trip (which was almost always one) and again by the number of persons in the party. A standard rate of 7 cents per mile was used to determine the average transportation expenditure per person per day. Only those miles which constituted the distance from the point of origin of the fishing trip and return were used. Occasionally, an individual was visiting nearby or was on a business trip to a town close to Ft. Peck Reservoir.

Immediate or trip expenditures consisted of food; lodging; purchases of bait; refreshments; rentals such as for boats, motors, and trailers; and miscellaneous. Since trip expenditures were made and recorded on a party basis, it was necessary to reduce the figures to a per-person basis. Only those food costs over and above those normally incurred at home were included.

RESULTS OF CREEL CENSUS

Based on information shown in Tables 3, 4, 5, 6, and 7, and previously described methods, it is estimated that the annual utilization and yield of Fort Peck Reservoir in 1948, 1949, and 1950 was approximately 15,500 fisherman-days, 46,000 fish, and 23,600 pounds of fish; 16,300 fisherman-days, 48,900 fish, and 22,100 pounds; and 20,400 fisherman-days, 53,800 fish and 40,700 pounds, respectively (Table 8). Annual utilization and yield of the fishery below Fort Peck Dam in 1948, 1949, and 1950 was estimated to be approximately 9,600 fisherman-days, 22,100 fish, and 22,600 pounds of fish; 5,800 fisherman-days, 12,500 fish, and 11,900 pounds of fish; and 5,800 fisherman-days, 7,500 fish and 7,000 pounds of fish, respectively (Table 9).

Examination of Table 8 reveals that utilization of the approximate 15 miles of reservoir shoreline in the immediate vicinity of Fort Peck Dam (Duck Creek to and including the upper spillway) is more than twice that of the remaining approximate shoreline 1,585 miles. Accessibility appears to be the important factor in limiting utilization in outlying areas; however, facilities for the convenience of fishermen and human population densities in the vicinity of points of access also must be taken into account. As previously indicated, access is generally limited to that portion of the reservoir in the immediate vicinity of the dam and a few specific outlying areas. Access to outlying areas was over rough, poorly maintained roads, generally passable only during fair weather. On the other hand, access to most areas adjacent to the dam was possible at all times of the year. Undoubtedly, as access roads to the various portions of the reservoir are improved, more and more use

Table 3. Number parties and fishermen contacted by check period and area, Fort Peck Reservoir and a

Census Period 1/	Check Area	Reservoir: Adjacent to Dam 1948 2/ Parties Contacted	1948 Fishermen Contacted	1949 Parties Contacted	1949 Fishermen Contacted	1950 Parties Contacted	1950 Fishermen Contacted	Check Area	Reservoir: 1948 Parties Contacted	1948 Fishermen Contacted	Below Dam: 1949 Fishermen Contacted	1950 Parties Contacted	1950 Fishermen Contacted
1	Upper Spillway			4/		4/		Rock Creek				4/	
2				4/		4/						2	2
3		618	1,665	9	19	441	1,144		76	221		1,061	2,190
4				431	1,193	27	53				2,345	17	33
5				4/		4/					37	1	1
6				4/		4/					7	4/	
Subtotal		618	1,665	440	1,212	468	1,197		76	221	2,389	1,081	2,226
1	Points East			4/		2	4	The Pines				4/	
2				4/		16	34				51	1	2
3		561	1,493	4/		373	973		26	76	37	166	419
4				464	1,273	9	15				301	4	10
5				25	63	1	2					1	2
6				3	8	4/					4	4/	
Subtotal		561	1,493	492	1,344	401	1,028		26	76	393	172	433
1	Dam & Dike			4/		4/		Hell Creek					
2				4/		1	2				1		
3		1,035	1,575	2	2	543	779		5	12	7		
4				176	291	4/					293		
5				4	4	4/							
6				1	1	4/							
Subtotal		1,035	1,575	183	298	544	781		5	12	301		
1	Recreation Area			4/		4/		Snow Creek					
2				4/		4/							
3		744 3/	1,875	4/		535	1,379		48	144			
4				379	934	9	25						
5				46	89	4/							
6				4	8	4/							
Subtotal		744	1,875	429	1,031	544	1,404		48	144			
1	Snob Hill			4/		4/		Timber Creek 6/					
2				4/		4/							
3		3/		4	11	214	554		2	8			
4				254	695	4	9						
5				11	24	4/							
6				4/		4/							
Subtotal				269	730	218	563		2	8			
1	Duck Creek			4/		4/		Bear Creek 7/					
2				4/		4/							
3		59	150			416	1,010						
4				552	1,492	16	35						
5				18	36	4/							
6				2	6	4/							
Subtotal		59	150	572	1,534	432	1,045						
Total		3,017	6,758	2,385	6,149	2,607	6,018		157	461	3,083	1,253	2,659

1949	1950
an. 18-24	Jan.12-19
ar. 3-10	Feb.17-23
pr. 19-25	Apr.15-Sept.14
une 2-Sept.14	Oct.22-25
ct. 22-30	Nov.16-19
ec. 3-9	Dec. 8-11

ng summer only
ation Area combined in 1948
acted
ng summer only
nly
nly
1949 only

Table 3. Number parties and fishermen contacted by check period and area, Fort Peck Reservoir and area below Fort Peck Dam, Montana, 1948, 1949, and 1950

Census Period 1/	Check Area	Reservoir: Adjacent to Dam 1948 2/ Parties Contacted	Fishermen Contacted	1949 Parties Contacted	Fishermen Contacted	1950 Parties Contacted	Fishermen Contacted
1	Upper Spillway			4/		4/	
2				4/		4/	
3		618	1,665	9	19	441	1,144
4				431	1,193	27	53
5				4/		4/	
6				4/		4/	
Subtotal		618	1,665	440	1,212	468	1,197
1	Points East			4/		2	4
2				4/		16	34
3		561	1,493	4/		373	973
4				464	1,273	9	15
5				25	63	1	2
6				3	8	4/	
Subtotal		561	1,493	492	1,344	401	1,028
1	Dam & Dike			4/		4/	
2				4/		1	2
3		1,035	1,575	2	2	543	779
4				176	291	4/	
5				4	4	4/	
6				1	1	4/	
Subtotal		1,035	1,575	183	298	544	781
1	Recreation Area			4/		4/	
2				4/		4/	
3		744 3/	1,875	4/		535	1,379
4				379	934	9	25
5				46	89	4/	
6				4	8	4/	
Subtotal		744	1,875	429	1,031	544	1,404
1	Snob Hill			4/		4/	
2				4/		4/	
3		3/		4	11	214	554
4				254	695	4	9
5				11	24	4/	
6				4/		4/	
Subtotal				269	730	218	563
1	Duck Creek			4/		4/	
2				4/		4/	
3		59	150			416	1,010
4				552	1,492	16	35
5				18	36	4/	
6				2	6	4/	
Subtotal		59	150	572	1,534	432	1,045
Total		3,017	6,758	2,385	6,149	2,607	6,018

Census Period 1/	Check Area	Reservoir: Outlying Areas 5/ 1948 Parties Contacted	Fishermen Contacted	1949 Parties Contacted	Fishermen Contacted	1950 Parties Contacted	Fishermen Contacted
1	Rock Creek						
2							
3		76	221			90	264
4				156	426		
5							
6							
Subtotal		76	221	156	426	90	264
1	The Pines						
2							
3		26	76			27	74
4				36	113		
5							
6							
Subtotal		26	76	36	113	27	74
1	Hell Creek						
2							
3		5	12			37	118
4				38	117		
5							
6							
Subtotal		5	12	38	117	37	118
1	Snow Creek						
2							
3		48	144			22	56
4				30	89		
5							
6							
Subtotal		48	144	30	89	22	56
1	Timber Creek 6/						
2							
3		2	8				
4							
5							
6							
Subtotal		2	8				
1	Bear Creek 7/						
2							
3						38	102
4							
5							
6							
Subtotal						38	102
Total		157	461	260	745	214	614

Census Period 1/	Check Area	Area Below Dam 1948 2/ Parties Contacted	Fishermen Contacted	1949 Parties Contacted	Fishermen Contacted	1950 Parties Contacted	Fishermen Contacted
1	Tunnels			4/		4/	
2				4/		2	2
3		1,317	2,738	4/		1,061	2,190
4				1,124	2,345	17	33
5				21	37	1	1
6				3	7	4/	
Subtotal		1,317	2,738	1,148	2,389	1,081	2,226
1	Lower Spillway			4/		4/	
2				20	51	1	2
3		1,082	2,801	15	37	166	419
4				268	301	4	10
5				4/		1	2
6				1	4	4/	
Subtotal		1,082	2,801	304	393	172	433
1	Borrow Pits 4/			4/			
2				1	1		
3		28	81	3	7		
4				116	293		
5				4/			
6				4/			
Subtotal		28	81	120	301		
Total		2,427	5,620	1,572	3,083	1,253	2,659

Footnotes:

1/ Census Periods

	1948	1949	1950
1		Jan. 18-24	Jan.12-19
2		Mar. 3-10	Feb.17-23
3	May 4-Sept.14	Apr. 19-25	Apr.15-Sept.14
4		June 2-Sept.14	Oct.22-25
5		Oct. 22-30	Nov.16-19
6		Dec. 3-9	Dec. 8-11

2/ Creel checks during summer only
3/ Snob Hill & Recreation Area combined in 1948
4/ No fishermen contacted
5/ Creel checks during summer only
6/ Checked in 1948 only
7/ Checked in 1950 only
8/ Checked in 1948 & 1949 only

Table 4. Recorded pole-hours, recorded fish, and rate of catch by

Census Period 1/	Check Area	Adjacent to Dam						Area Below Dam						
		Recorded Pole-hours			Recorded Fish			urs	Recorded Fish			Rate of Catch		
		1948 2/	1949	1950	1948	1949	1950	1950	1948	1949	1950	1948	1949	1950
1	Upper Spillway		4/	4/				4/						
2			4/	4/				2.0			0			0.00
3		5,607.5	28.0	4,357.5	3,778	62	3,751	5,071.5	3,326		1,867	0.43		0.37
4			4,235.5	205.5		4,078	220	93.0		3,943	92		0.64	0.97
5			4/	4/				1.5		30	1		0.41	0.67
6			4/	4/				4/		0			0.00	
Total		5,607.5	4,263.5	4,563.0	3,778	4,140	3,971	5,168.0	3,326	3,973	1,960			
1	Points East		4/	13.0			19	4/						
2			4/	113.0			51	4.0		424	2		1.95	0.50
3		4,417.0	4/	3,296.0	3,105		1,729	1,594.5	11,349	18	1,022	0.95	0.16	0.64
4			4,006.0	41.5		3,805	24	43.0		1,050	62		1.04	1.44
5			240.5	2.0		342	1	3.0			0			0.00
6			34.0	4/		1		4/		0			0.00	
Total		4,417.0	4,280.5	3,465.5	3,105	4,148	1,820	1,644.5	11,349	1,492	1,086			
1	Dam & Dike		4/	4/										
2			4/	6.0			0			0			0.00	
3		2,780.5	1.5	1,292.0	802	0	841		132	0		0.66	0.00	
4			613.0	4/		473				502			0.54	
5			6.0	4/		2								
6			0.5	4/		0								
Total		2,780.5	621.0	1,298.0	802	475	841		132	502				
1	Recreation Area		4/	4/										
2			4/	4/										
3		5,234.0 3/	4/	4,412.0	3,257		1,914							
4			2,662.0	62.5		1,169	39							
5			345.0	4/		392								
6			13.5	4/										
Total		5,234.0	3,020.5	4,474.5	3,257	1,561	1,953							
1	Snob Hill		4/	4/										
2			4/	4/										
3		3/	32.0	1,827.0		9	1,037							
4			2,035.0	34.0		1,054	61							
5			68.0	4/		102								
6			4/	4/										
Total			2,135.0	1,861.0		1,165	1,098							
1	Duck Creek		4/	4/										
2			4/	4/										
3		509.0	4/	3,700.0	342		1,659							
4			5,316.0	88.5		3,246	31							
5			116.5	4/		125								
6			12.0	4/		1								
Total		509.0	5,444.5	3,788.5	342	3,372	1,690							
Grand Total		18,548.0	19,765.0	19,450.5	11,284	14,861	11,373	6,812.5	14,807	5,967	3,046			

Footnotes:

1/ Census periods

	1948	1949	1950
1		Jan. 18-24	Jan. 12-19
2		Mar. 3-10	Feb. 17-23
3	May 4-Sept. 14	Apr. 19-25	Apr. 15-Sept. 14
4		June-Sept. 14	Oct. 22-28
5		Oct. 22-30	Nov. 16-19
6		Dec. 3-9	Dec. 8-11

2/ Creel check during summer only

3/ Snob Hill & Recreation Area combined in 1948

4/ No fishermen contacted

5/ Creel check during summer only

6/ Checked in 1948 only

7/ Checked in 1950 only

8/ Checked in 1948 & 1949 only

Table 4. Recorded pole-hours, recorded fish, and rate of catch by check periods and areas, Fort Peck Reservoir and area below Fort Peck Dam, Montana, 1948, 1949, and 1950

Census Period 1/	Check Area	Reservoir: Adjacent to Dam — Recorded Pole-hours			Recorded Fish			Rate of Catch		
		1948 2/	1949	1950	1948	1949	1950	1948	1949	1950
1	Upper Spillway		4/	4/						
2			4/	4/						
3		5,607.5	28.0	4,357.5	3,778	62	3,751	0.67	2.21	0.86
4			4,235.5	205.5		4,078	220		0.95	1.07
5			4/	4/						
6			4/	4/						
Total		5,607.5	4,263.5	4,563.0	3,778	4,140	3,971			
1	Points East		4/	13.0			15			1.15
2			4/	113.0			51			0.45
3		4,417.0	4/	3,296.0	3,105		1,729	0.70		0.52
4			4,006.0	41.5		3,805	24		0.95	0.58
5			240.5	2.0		342	1		1.26	0.50
6			34.0	4/		1			0.03	
Total		4,417.0	4,280.5	3,465.5	3,105	4,148	1,820			
1	Dam & Dike		4/	4/						
2			4/	6.0			0			0.00
3		2,780.5	1.5	1,292.0	802	0	841	0.21	0.00	0.65
4			613.0	4/		473			0.77	
5			6.0	4/		2			0.33	
6			0.5	4/		0			0.00	
Total		2,780.5	621.0	1,298.0	802	475	841			
1	Recreation Area		4/	4/						
2			4/	4/						
3		5,234.0 3/	4/	4,412.0	3,257		1,914	0.62		0.43
4			2,662.0	62.5		1,169	39		0.44	0.62
5			345.0	4/		392			1.14	
6			13.5	4/					0.00	
Total		5,234.0	3,020.5	4,474.5	3,257	1,561	1,953			
1	Snob Hill		4/	4/						
2			4/	4/						
3		3/	32.0	1,827.0		9	1,037		0.28	0.57
4			2,035.0	34.0		1,054	61		0.52	1.79
5			68.0	4/		102			1.50	
6			4/	4/						
Total			2,135.0	1,861.0		1,165	1,098			
1	Duck Creek		4/	4/						
2			4/	4/						
3		509.0	4/	3,700.0	342		1,659	0.67		0.46
4			5,316.0	88.5		3,246	31		0.61	0.35
5			116.5	4/		125			1.08	
6			12.0	4/		1			0.08	
Total		509.0	5,444.5	3,788.5	342	3,372	1,690			
Grand Total		18,548.0	19,765.0	19,450.5	11,284	14,861	11,373			

Census Period 1/	Check Area	Reservoir: Outlying Areas 5/ — Recorded Pole-hours			Recorded Fish			Rate of Catch		
		1948	1949	1950	1948	1949	1950	1948	1949	1950
1	Rock Creek									
2										
3		1,092.5		1,474.0	1,645		954	1.51		0.65
4			1,984.0			2,511			1.27	
5										
6										
Total		1,092.5	1,984.0	1,474.0	1,645	2,511	954			
1	The Pines									
2										
3		240.0		239.5	131		161	0.55		0.67
4			491.0			185			0.38	
5										
6										
Total		240.0	491.0	239.5	131	185	161			
1	Hell Creek									
2										
3		77.5		1,218.5	75		457	0.97		0.38
4			556.5			348			0.63	
5										
6										
Total		77.5	556.5	1,218.5	75	348	457			
1	Snow Creek									
2										
3		718.0		311.5	526		195	0.23		0.63
4			482.5			187			0.39	
5										
6										
Total		718.0	482.5	311.5	526	187	195			
1	Timber Creek 6/									
2										
3		67.0			88			1.31		
4										
5										
6										
Total		67.0			88					
1	Bear Creek 7/									
2										
3				655.0			463			0.71
4										
5										
6										
Total				655.0			463			
Grand Total		2,195.0	3,514.0	3,898.5	2,465	3,231	2,230			

Census Period 1/	Check Area	Area Below Dam: Recorded Pole-hours			Recorded Fish			Rate of Catch		
		1948 2/	1949	1950	1948	1949	1950	1948	1949	1950
1	Tunnels		4/	4/						
2			4/	2.0			0			0.00
3		7,688.0	4/	5,071.5	3,326		1,867	0.43		0.37
4			6,092.0	93.0		3,943	92		0.64	0.97
5			74.0	1.5		30	1		0.41	0.67
6			28.5	4/		0			0.00	
Total		7,688.0	6,194.5	5,168.0	3,326	3,973	1,960			
1	Lower Spillway		4/	4/						
2			217.0	4.0		424	2		1.95	0.50
3		11,965.0	110.5	1,594.5	11,349	18	1,022	0.95	0.16	0.64
4			1,013.5	43.0		1,050	62		1.04	1.44
5			4/	3.0			0			0.00
6			22.0	4/		0			0.00	
Total		11,965.0	1,363.0	1,644.5	11,349	1,492	1,086			
1	Barrow Pits 8/		4/							
2			2.0			0			0.00	
3		198.5	8.5		132	0		0.66	0.00	
4			934.0			502			0.54	
5			4/							
6			4/							
Total		198.5	944.5		132	502				
Grand Total		19,851.5	8,502.0	6,812.5	14,807	5,967	3,046			

Footnotes:

1/ Census periods

	1948	1949	1950
1		Jan. 18-24	Jan. 12-19
2		Mar. 3-10	Feb. 17-23
3	May 4-Sept. 14	Apr. 19-25	Apr. 15-Sept. 14
4		June-Sept. 14	Oct. 22-28
5		Oct. 22-30	Nov. 16-19
6		Dec. 3-9	Dec. 8-11

2/ Creel check during summer only

3/ Snob Hill & Recreation Area combined in 1948

4/ No fishermen contacted

5/ Creel check during summer only

6/ Checked in 1948 only

7/ Checked in 1950 only

8/ Checked in 1948 & 1949 only

Tabl0

Area Below Dam

	1/	1949				1950			
	eason	Summer Season		Off-season		Summer Season		Off-season	
	%	No.	%	No.	%	No.	%	No.	%
Saug	34.63	2,253	41.00	91	19.28	1,555	53.82	44	28.03
Yell	0.81	3	0.05	0		11	0.39	0	
Yell	31.86	376	6.84	329	69.70	141	4.88	11	7.01
Gold	23.93	2,567	46.72	32	6.78	759	26.27	80	50.95
Trou	0.59	44	0.80	0		37	1.28	4	2.55
Lake		0		0		3	0.10	0	
Koka		0		0		0		0	
Stur	0.51	11	0.20	1	0.21	24	0.83	0	
Burb	0.51	14	0.25	19	4.03	30	1.04	3	1.91
Blac	0.43	19	0.35	0		0		0	
Carp	0.34	37	0.67	0		27	0.93	2	1.27
Drum	0.33	30	0.54	0		9	0.31	0	
Padd	0.03	1	0.02	0		0		0	
Suck	0.02	8	0.15	0		2	0.07	0	
Flat	0.01	5	0.09	0		38	1.32	0	
Blac	0.02	3	0.06	0		9	0.31	0	
Chan	5.97	123	2.24	0		244	8.45	13	8.28
Larg	0.01	0		0		0		0	
Gar		1	0.02	0		0		0	
	100.00	5,495	100.00	472	100.00	2,889	100.00	157	100.00

1/ Cr

Table 5. Number and percent of recorded fish by species, season, and check area, Fort Peck Reservoir and Area below Fort Peck Dam, Montana, 1948, 1949, and 1950

Species	Reservoir																Area Below Dam									
	Adjacent to Dam										Outlying Areas [1]															
	1948 [1]		1949				1950				1948		1949		1950		1948 [1]		1949				1950			
	Summer Season		Summer Season		Off-season		Summer Season		Off-season		Summer Season		Summer Season		Summer Season		Summer Season		Summer Season		Off-season		Summer Season		Off-season	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Sauger	569	5.04	574	4.17	54	5.21	1,572	14.34	39	8.82	78	3.16	153	4.73	219	9.82	5,127	34.63	2,253	41.00	91	19.28	1,555	53.82	44	28.03
Yellow pike-perch	7	0.06	0		0		0		0		0		1	0.03	0		120	0.81	3	0.05	0		11	0.39	0	
Yellow perch	8,280	73.38	11,026	80.17	778	75.12	5,936	54.17	267	60.41	2,196	89.09	2,649	81.99	1,296	58.13	4,717	31.86	376	6.84	329	69.70	141	4.88	11	7.01
Goldeye	1,513	13.40	1,577	11.45	53	5.11	2,548	23.24	45	10.17	81	3.29	196	6.06	362	16.23	3,543	23.93	2,567	46.72	32	6.78	759	26.27	80	50.95
Trout	329	2.92	115	0.83	9	0.86	197	1.79	6	1.36	8	0.33	6	0.19	3	0.13	87	0.59	44	0.80	0		37	1.28	4	2.55
Lake trout	0		0		1	0.10	2	0.02	0		0		0		0		0		0		0		3	0.10	0	
Kokanee	3	0.03	0		0		0		0		0		0		0		0		0		0		0		0	
Sturgeon	16	0.14	1	0.01	0		2	0.02	0		0		0		0		76	0.51	11	0.20	1	0.21	24	0.83	0	
Burbot	1	0.01	13	0.09	131	12.64	356	3.25	83	18.78	1	0.04	1	0.03	45	2.02	75	0.51	14	0.25	19	4.03	30	1.04	3	1.91
Black crappie	246	2.18	203	1.47	9	0.86	102	0.93	0		12	0.49	32	0.99	35	1.57	64	0.43	19	0.35	0		0		0	
Carp	146	1.29	117	0.85	1	0.10	80	0.73	1	0.23	6	0.24	10	0.31	36	1.61	51	0.34	37	0.67	0		27	0.93	2	1.27
Drum	10	0.09	15	0.10	0		32	0.29	0		22	0.89	28	0.87	62	2.78	49	0.33	30	0.54	0		9	0.31	0	
Paddlefish	0		0		0		0		0		0		0		0		5	0.03	1	0.02	0		0		0	
Suckers	13	0.12	11	0.07	0		29	0.26	0		1	0.04	0		2	0.09	3	0.02	8	0.15	0		2	0.07	0	
Flathead chub	2	0.02	1	0.01	0		0		0		0		0		0		2	0.01	5	0.09	0		38	1.32	0	
Black bullhead	83	0.74	44	0.31	0		16	0.15	0		21	0.85	65	2.01	10	0.45	3	0.02	3	0.06	0		9	0.31	0	
Channel catfish	66	0.58	65	0.47	0		89	0.81	1	0.23	39	1.58	90	2.79	160	7.17	884	5.97	123	2.24	0		244	8.45	13	8.28
Largemouth black bass	0		0		0		0		0		0		0		0		1	0.01	0		0		0		0	
Gar	0		0		0		0		0		0		0		0		0		1	0.02	0		0		0	
Total	11,284	100.00	13,762	100.00	1,036	100.00	10,961	100.00	442	100.00	2,465	100.00	3,231	100.00	2,230	100.00	14,807	100.00	5,495	100.00	472	100.00	2,889	100.00	157	100.00

[1] Creel check during summer only.

Table 6. Average weight of fish in a non-selective sample from fisherman's creel, Fort Peck Reservoir and area below Fort Peck Dam, Montana 1948, 1949, and 1950 1/

Species	1948		1949		1950	
	No. in sample	Average weight*	No. in sample	Average weight*	No. in sample	Average weight*
Sauger	137	1.40	91	1.26	434	1.26
Yellow pikeperch	2/	1.50	1	2.60	3	2.20
Yellow perch	332	0.38	240	0.30	123	0.30
Goldeye	30	0.68	70	0.61	69	0.69
Trout (rainbow & brown)	98	3.10	44	2.77	147	2.18
Lake trout	--		2/	2.00	5	3.94
Kokanee	2/	3.00	--	--		
Shovelnose sturgeon	2/	3.00	2/	3.00	2	14.75
Burbot	2/	2.00	2/	2.00	70	2.46
Black crappie	62	0.70	18	1.07	13	0.66
Carp	7	3.10	4	3.43	12	3.74
Freshwater drum	5	2.40	1	2.60	17	1.81
Paddlefish	2/	10.00	2/	10.00	--	
Sucker (several sp.)	3	0.67	2/	0.67	3	1.15
Flathead chub	2/	0.75	2/	0.75	2/	0.50
Black bullhead	2/	0.50	2/	0.50	6	0.51
Channel catfish	2/	3.00	1	2.40	88	2.64
Largemouth black bass	2/	0.75	--		--	
Shortnose gar	--		2/	1.00	--	

* In pounds

1/ There was some variation in the average weight of the various species from the area below the dam, the reservoir adjacent to dam, and outlying areas, and where the samples from any area were sufficient to warrant use of the average weight as determined for that area, such average weights were used in calculating the total poundage taken.

2/ No specimens actually weighed. Weight estimated for purpose of computing weight of estimated total catch.

3/ No specimens actually weighed. Average weight as determined in the previous year used in computing weight of estimated total catch.

Table 7. Estimated utilizati

Area	Number Week-da Checks	Total Estimated Number Fisherman-days May 15 Thru Oct. 31	Total Estimated Number Fish Caught May 15 Thru Oct. 31	Total Estimated Weight of Fish Caught May 15 Thru Oct. 31
1948				
Rock Creek	5	1,760	13,050	6,520
The Pines	2	690	1,170	580
Hell Creek	2	200	1,220	590
Snow Creek	2	1,780	6,420	3,210
Timber Creek 1/	2	210	1,140	570
Bear Creek 2/	--	550	2,700	1,760
Total	13	5,190	25,700	13,230
1949				
Rock Creek	24	2,130	12,540	5,730
The Pines	24	720	1,150	530
Hell Creek	24	700	2,110	970
Snow Creek	24	1,050	2,200	1,010
Timber Creek 1/	--	280	1,370	690
Bear Creek 2/	--	600	2,940	1,920
Total	96	5,480	22,310	10,850
1950				
Rock Creek	20	1,840	9,210	5,780
The Pines	19	550	1,430	1,140
Hell Creek	19	720	2,970	3,570
Snow Creek	19	260	1,210	2,440
Timber Creek 1/	--	200	1,100	550
Bear Creek 2/	14	700	3,450	2,250
Total	91	4,270	19,370	15,730

1/ Checked in 1948 only
2/ Checked in 1950 only

Table 7. Estimated utilization and yield for outlying areas, Fort Peck Reservoir, Montana, 1948, 1949, 1950

Area	Number Week-day Checks	Average Number Fisherman-days Per Week Day	Number Week-end Day & Holiday Checks	Average Number Fisherman-days Per Week-end Day & Holiday	Number Week Days May 15 Thru Oct. 31	Number Week-end Days & Holidays May 15 Thru Oct. 31	Average Number Fish Caught Per Fisherman-day	Total Estimated Number Fisherman-days May 15 Thru Oct. 31	Total Estimated Number Fish Caught May 15 Thru Oct. 31	Total Estimated Weight of Fish Caught May 15 Thru Oct. 31
1948										
Rock Creek	5	5.6	10	20.9	117	53	7.4	1,760	13,050	6,520
The Pines	2	1.3	7	10.1	117	53	1.7	690	1,170	580
Hell Creek	2	1.0	8	1.5	117	53	6.2	200	1,220	590
Snow Creek	2	8.0	8	16.0	117	53	3.6	1,780	6,420	3,210
Timber Creek 1/	2	1.5	8	.6	117	53	5.5	210	1,140	570
Bear Creek 2/	--	--	--	--	--	--	--	550	2,700	1,760
Total	13		41					5,190	25,700	13,230
1949										
Rock Creek	24	10.2	7	17.6	117	53	5.9	2,130	12,540	5,730
The Pines	24	2.1	7	8.9	117	53	1.6	720	1,150	530
Hell Creek	24	2.7	7	7.3	117	53	3.0	700	2,110	970
Snow Creek	24	1.9	12	15.6	117	53	2.1	1,050	2,200	1,010
Timber Creek 1/	--	--	--	--	--	--	--	280	1,370	690
Bear Creek 2/	--	--	--	--	--	--	--	600	2,940	1,920
Total	96		33					5,480	22,310	10,850
1950										
Rock Creek	20	8.4	12	16.2	117	53	5.0	1,840	9,210	5,780
The Pines	19	2.3	12	5.3	117	53	2.6	550	1,430	1,140
Hell Creek	19	2.7	12	7.7	117	53	4.1	720	2,970	3,570
Snow Creek	19	0.4	11	4.1	117	53	4.6	260	1,210	2,440
Timber Creek 1/	--	--	--	--	--	--	--	200	1,100	550
Bear Creek 2/	14	2.7	11	7.3	117	53	4.9	700	3,450	2,250
Total	91		58					4,270	19,370	15,730

1/ Checked in 1948 only
2/ Checked in 1950 only

Table 8. Estimated annual uti

Utilization & Yield		r of Reservoir		Entire Reservoir		
		1949	1950	1948	1949	1950
	Mai Cer Per	Total	Total	Total	Total	Total
Estimated utilization in fisherman-days	7,	5,450	4,370	15,450	16,300	20,380
Estimated yield in number of fish	13,	22,310	19,370	46,000	48,910	53,800
Estimated yield in pounds of fish	6,	8,850	15,730	23,630	22,150	40,700

50	
nder	Total
900	5,790
400	7,480
300	6,960

Table 8. Estimated annual utilization and yield, Fort Peck Reservoir, Montana, 1948, 1949, and 1950

Utilization & Yield	Adjacent To Dam									Remainder of Reservoir			Entire Reservoir		
	1948			1949			1950			1948	1949	1950	1948	1949	1950
	Main Census Period	Remainder of Year	Total	Main Census Period	Remainder of Year	Total	Main Census Period	Remainder of Year	Total	Total	Total	Total	Total	Total	Total
Estimated utilization in fisherman-days	7,860	2,400	10,260	8,430	2,420	10,850	14,300	1,710	16,010	5,190	5,450	4,370	15,450	16,300	20,380
Estimated yield in number of fish	13,300	7,000	20,300	19,400	7,200	26,600	29,800	4,630	34,430	25,700	22,310	19,370	46,000	48,910	53,800
Estimated yield in pounds of fish	6,900	3,500	10,400	9,100	4,200	13,300	21,600	3,370	24,970	13,230	8,850	15,730	23,630	22,150	40,700

Table 9. Estimated annual utilization and yield, area below Fort Peck Dam, Montana, 1948, 1949, and 1950

Utilization & Yield	1948			1949			1950		
	Main Census Period	Remainder of Year	Total	Main Census Period	Remainder of Year	Total	Main Census Period	Remainder of Year	Total
Estimated utilization in fisherman-days	6,600	3,000	9,600	4,200	1,550	5,750	4,890	900	5,790
Estimated yield in number of fish	17,100	5,000	22,100	8,920	3,600	12,520	6,080	1,400	7,480
Estimated yield in pounds of fish	17,600	5,000	22,600	8,530	3,410	11,940	5,660	1,300	6,960

will be made of the reservoir. The above assumption is borne out in part by the increased use of Rock Creek and Hell Creek during the period of study (Table 7). Use of these areas generally increased each year as roads were improved and facilities of convenience were provided. At the same time, use at some of the other outlying areas, notably Snow Creek which was not developed, dropped off rather rapidly, further indicating that accessibility and development are important factors in utilization of an area. As will be shown later, the Fort Peck fishery is of major importance to only those people within about 50 miles of the fishery. Since the human population (about 0.7 people per square mile in 1950) within a 50-mile radius of most outlying areas did not materially change in the 3-year study, a decrease in utilization of the more inaccessible areas would be expected with an increased utilization of the more accessible areas.

Increased utilization of Rock Creek and Hell Creek as determined from the limited creel checks made during the course of the study were borne out by incomplete records[1/] kept by Montana Park Commission employees stationed at these two areas during the summer of 1949 and 1950.

There were minor variations in the rate of catch (Table 4) and the weight of fish caught (not fully reflected in Table 6) at the various outlying areas under observation, but on the whole these apparently were not of sufficient magnitude to encourage many fishermen to travel the extra miles or take the necessary chances of becoming isolated for a few days to journey to the less accessible areas.

1/ Because of the layout of the areas it was not possible for Park Commission employees to check everyone utilizing the areas.

Almost 92 percent, 95 percent, and 90 percent of the catch for 1948, 1949, and 1950, respectively, was composed of yellow perch, goldeye, and sauger, the three most abundant fishes in the creels checked at the reservoir (Table 5). Goldeye, a species usually discarded, made up about 12 percent, 10 percent, and 22 percent of the catch during the three years.

As at the reservoir, sauger, goldeye, and yellow perch were the three most abundant fishes examined in the creels below the dam. These three fishes made up about 90 percent, 95 percent, and 85 percent of the catch below the dam in 1948, 1949, and 1950, respectively (Table 5). Goldeye made up 24 percent, 47 percent, and 28 percent of the catch during the three years.

Analysis of data presented in Table 5 indicates a decline of yellow perch in the Fort Peck fishery over the three-year period, especially in the area below the dam. In 1948, yellow perch composed about one-third of the catch below the dam, but dropped to about 5 percent of the catch in 1949 and 1950. In the reservoir adjacent to the dam roughly three-quarters of the catch was composed of yellow perch in 1948 and 1949, but this species comprised only about one-half of the catch in 1950. The same general trend was evident at the outlying areas, but since the samples from these areas were relatively small, the trend indicated might not have the same significance. As indicated by Eschmeyer and Smith (1943) there may be a correlation between the prevailing low-water temperatures below the dam and the decline in the perch, as well as the general decline in the numbers of all warm water fish harvested each year (Table 9). Since goldeye were usually discarded,

it was difficult to obtain an accurate count of this species; therefore, goldeye probably made up a higher percentage of the catch in all areas than indicated in Table 5.

Minor seasonal changes in composition of catch were noted throughout the period of study (Table 5). Burbot were rarely taken during the summers, whereas catfish were rarely taken during the winters.

Marked variation in rate of catch occurred at various seasons and among the different fishing sites (Table 4). The higher rate of catch shown for the off-season periods is believed to be largely due to the unfavorable weather conditions which probably discouraged all but the most skilled and ardent fishermen, whereas, both skilled and unskilled anglers fished during the more favorable summer months.

In order to arrive at a fair comparison of the utilization and yield over a 3-year period it is necessary to reduce the figures to a comparable time and area basis. Since periodic off-season checks were not made in 1948, nor over the same periods in 1949 and 1950, no comparison can be made of the fishery during the winter period. It is possible, however, to make a comparison on the basis of comparable summer periods. Since the 1949 summer census was conducted over a 105-day period, as compared to a 132-day period in 1948, and a 155-day period in 1950, the comparison for the 3 years is confined to the corresponding 105-day period in each year. Also, since the borrow pits were not checked in 1950, Timber Creek was checked in 1948 by airplane only, and Bear Creek was checked in 1950 only, these areas have not been included in the comparison.

Analysis of the data obtained for comparable 105-day periods and comparable areas for the three-year period of study indicates the following (see Table 10 for a detailed breakdown of the comparison):

(1) The number of fisherman-days increased about 11 percent from 1948 to 1949, and about 27 percent from 1949 to 1950.

(2) The progressive increase in the number of fisherman-days was not accompanied by a corresponding increase in number of fish caught. From 1948 to 1949, there was virtually no change in the number of fish caught, and from 1949 to 1950, there was an increase of only about 8 percent. The increase in the latter case was due to more effort (in terms of pole-hours) expended by the fishermen.

(3) The average rate of catch per pole-hour declined 0.10 fish from 1948 to 1949, and 0.23 fish from 1949 to 1950.

(4) The decrease in the average weight of the fish from 0.71 pounds in 1948 to 0.56 pounds in 1949, and the increase to 0.78 pounds in 1950 are largely due to a change in the composition of the catch, and to a lesser extent to a change in the average weights of the various species of fish caught.

With the exception of casting for trout off the Dam and Dike, still-fishing with live minnows was the principal means of taking fish in Fort Peck Reservoir. Set lines were used, primarily for catfish,

in a few of the outlying areas. Fishermen likewise favored still-fishing with live minnows below the dam, but casting and still-fishing with a variety of other baits was occasionally employed. Although boat fishing is gaining considerably in popularity, most of the fishing in Fort Peck Reservoir and below the dam is from the bank.

Table 10. Comparison of creel data obtained from June 2 - Sept. 14, 1949, with those obtained during the corresponding 105-day periods in 1948 and 1950, Fort Peck Reservoir and Area Below the Dam, Montana

Item	1948	1949	1950
Total estimated number of fisherman-days	13,632	15,139	19,255
Total estimated number of fish taken	40,088	39,799	43,194
Total estimated weight of fish taken	28,452	22,562	33,691
Average rate of catch per pole hour1/	0.93	0.83	0.60
Average number of fish per fisherman-day1/	2.94	2.63	2.24
Average pounds of fish per fisherman-day1/	2.09	1.49	1.75
Average hours fished by anglers1/	3.16	3.18	3.76
Average weight of fish1/	0.71	0.56	0.78

1/ Weighted according to number of anglers in the sample.

The Fort Peck fishery serves principally local people. Over the three-year study period, about 82 percent of the people who fished in the reservoir and below the dam came from Glasgow, Fort Peck, Nashua, and Wolf Point, all within a 50-mile radius (Table 11). Generally speaking, fishermen using the outlying areas came from the towns nearest the fishing sites. Only about 3 percent of the fishermen interviewed

Table 11. Nck Dam, Montana, 1948, 1949, and 1950

Point of Origin of Trip	%	Grand Total							
		1948		1949		1950		3-Year Total	
		No.	%	No.	%	No.	%	No.	%
Fort Peck (immediate vicinity, pop. 1,191)	1								
Nashua (12 mile distant, pop. 950)	2								
Glasgow (20 mile distant, pop. 3,810)	--								
Wolf Point (50 mile distant, pop. 2,547)									
Sub-total- 4 major towns within 50 mi. radius									
All other residents									
TOTAL 1/	3	5,386	100	3,743	100	4,074	100	13,203	100

1/ Totals no

Table 11. Number and percent of fishing parties and point of origin of fishing trips, resident and non-resident, Fort Peck Reservoir and area below Fort Peck Dam, Montana, 1948, 1949, and 1950

Point of Origin of Trip	Resident Parties								Point of Origin of Trip	Non-resident Parties								Grand Total							
	1948		1949		1950		3-Year Total			1948		1949		1950		3-Year Total		1948		1949		1950		3-Year Total	
	No.	%	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Fort Peck (immediate vicinity, pop. 1,191)	2,317	43	1,194	32	1,092	27	4,603	35	North Dakota	58	1	65	2	59	1	182	1								
Nashua (12 mile distant, pop. 950)	195	4	147	4	180	4	522	4	Other states and District of Columbia	87	2	69	2	68	2	224	2								
Glasgow (20 mile distant, pop. 3,810)	1,603	30	1,466	39	1,696	42	4,765	36	Canadian Provinces	2	--	5	--	2	--	9	--								
Wolf Point (50 mile distant, pop. 2,547)	358	7	248	7	298	7	904	7																	
Sub-total- 4 major towns within 50 mi. radius	4,473	83	3,055	82	3,266	80	10,794	82																	
All other residents	766	14	549	15	679	17	1,994	15																	
TOTAL 1/	5,239	97	3,604	96	3,945	97	12,788	97		147	3	139	4	129	3	415	3	5,386	100	3,743	100	4,074	100	13,203	100

1/ Totals not necessarily same as totals shown in Table 3 because adequate information not obtained on all parties contacted.

were non-residents. About 45 percent of the non-resident fishermen came from North Dakota. With the exception of North Dakota fishermen, who usually came to the reservoir purposely to fish, most non-resident fishermen came to Fort Peck or Glasgow on business or to visit relatives, and fishing at Fort Peck was incidental to such trips. Twenty-six different states, and two Canadian provinces were represented by the parties contacted during the 3-year study period.

Of the total number of anglers contacted over the 3-year period, about 66 percent were men, 23 percent were women, and 11 percent were children. The relatively high percentage of women and children is largely due to the recreational facilities developed at various sites by the U. S. Corps of Engineers. Families from nearby towns utilized these facilities on week ends and holidays and on week-day evenings.

Although few large catches were made, most fishermen were successful in catching one or more fish per trip. It must be borne in mind, however, that in many instances the one or more fish which qualified the fisherman as being successful, was the unpopular, usually discarded goldeye. Therefore, on the above basis, to say that a definite percentage of the fishermen were successful would be misleading. Each year a few fishermen made catches of over 100 yellow perch per trip , usually in the Upper Spillway Channel area.

Most of the fishing at Fort Peck Reservoir occurs between the first of June and the end of September. Cold weather and high winds discourage early spring, late fall, and winter ice-fishing. Since there is little ice-fishing at Fort Peck Reservoir and most of the open-water fishing usually starts one month after the ice breaks up, it is of

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interest to note the following dates in regard to ice formation and breakup. For the 3-year period, the ice formation and ice breakup dates were: January 16, and April 16, 1948; December 24, 1948, and April 20, 1949; and December 31, 1949, and May 9, 1950.

The Tunnel Area was the most heavily utilized area below the dam (Fig. 3), except in 1948 when the Lower Spillway Channel was the most heavily utilized area. Water continued to flow over the spillway for a greater period of time in 1948, thus creating better fishing conditions in the Lower Spillway area. The fact that yellow perch were readily caught in the Lower Spillway in 1948 also contributed to the greater utilization.

The Upper Spillway Channel was the most heavily utilized of the areas of the reservoir adjacent to the dam over the 3-year study period (Fig. 4). This area also consistently yielded the best catches of yellow perch. During 1949, fishing was restricted on the Dam and Pike because of construction activities; resulting in a decline in the number of trout caught that year. More trout were taken off the face of the dam than any other single area in the reservoir. Trout probably frequented this area because the gravel on the face of the dam would seem to offer spawning sites.

Rock Creek was the most heavily fished and produced more fish, with a higher rate of catch, than did the other outlying areas.

RESULTS OF FISHERMAN EXPENDITURE STUDY

Expenditure data were obtained during all three years of the study of the Fort Peck Fishery, on the thesis that expenditures made by the fishermen using a fishery are a reflection of its value.

As already indicated, slightly different procedures were used for obtaining basic information each of the three years. This in turn required a slightly different analysis for each year; and for a complete understanding of the results, a separate discussion for each year. As will be shown, the results were quite uniform, in spite of the variation in coverage and methods used.

Transportation Expenditure

Mileage recorded for 108 parties (237 individuals) was used in 1948 as a basis for determining the average number of miles traveled per person per day. An average of 21 miles (round trip) was obtained, which multiplied by 7 cents per mile, would amount to an expenditure of $1.47 per person per day.

In 1949, the average number of miles for 708 individuals (340 parties) was 23 per person per day, which, when converted to a cost basis, amounted to $1.61.

The expenditure for transportation in 1950 averaged $1.40 per person per day, based on an average of 20 miles per person per day, as determined from interviews with 4,020 parties consisting of 9,136 anglers. The average expenditure, weighted by the number of individuals in the sample, for transportation for the three years was $1.42 per person per day.

Trip Expenditures

In 1948, the 108 individuals contacted spent an average of $0.74 per person per day for food, lodging, and miscellaneous items. Of the $0.74, $0.42 was spent for miscellaneous, primarily bait and refreshments, $0.30 for food; and $0.02 for lodgings. The negligible expenditure for lodging indicates the predominantly local attraction of the fishery.

In 1949, 708 individuals spent an average of $0.99 for immediate trip items. Of the total, $0.34 was spent for food, $0.29 for miscellaneous, $0.17 each for bait and lodgings, $0.01 for boat and motor rentals, and the remaining cent was spent for fees and other rentals.

Trip expenditures in 1950 totaled $0.35, $0.19 of which was spent for bait, $0.08 for food, $0.04 for miscellaneous, $0.03 for lodgings, and $0.01 for fees and boat and motor rentals. The above expenditures were derived from a total of 9,186 fishermen.

The average weighted trip expenditure for the three-year period was $0.40 per person per day.

Annual expenditures

Annual expenditures in 1948, which consisted of license fees and contributions (club memberships included) and were based on 108 individual contacts, totaled $0.23 per person per day.

In 1949, annual expenditures were considerably less, being only $0.08 for the 708 individuals contacted. As explained under methods, an annual usage of 25 was assumed for most of the 708 persons involved, which may account in part for the smaller annual expenditure.

Information on annual expenditures was not obtained from fisherman contacted during the creel census in 1950, but data obtained through a survey of license holders in Roosevelt and Valley Counties, Montana[1/] (Anonymous, 1951) were applied. The reported annual expenditure for the average warm-water fisherman from Valley and Roosevelt Counties

1/ These two counties lie adjacent to Fort Peck Reservoir.

was $0.71 per person per day. The reader should recognize that data gathered in the Roosevelt and Valley Counties survey refer to the per-person, per-day expenditure of the average license holder, and not to the expenditure of the average fisherman in the field with which this report is concerned. A difference exists between expenditures of the average license holder and the average fisherman in the field. The more avid fisherman, due to the frequency of his trips (and greater utilization of his equipment); has a lower per-day expenditure, and also a greater chance of being interviewed in the field than the occasional angler. Expenditure data for the average fisherman, then, is the expenditure for the average license holder, weighted according to the number of times he went fishing.

Consequently, a modification is necessary to convert the county survey annual expenditure figure (for the average license holder) to the annual expenditure of the average fisherman in the field. By dividing the average season cost ($16.00) for annual and investment items in the Roosevelt and Valley Counties survey by the average number of days spent warm-water fishing (16), the cost per day ($1.00) for the average fisherman in the field is determined (Anonymous, 1951). This $1.00 represents about one-half of the annual and investment per day expenditure reported for the average license holder ($2.01). Assuming that the same relationship exists for annual expenditure as for the combined annual and investment expenditure, one-half of the $0.71 annual expenditure assigned to the average license holder should result in an approximation of the average expenditure of the fishermen who utilized Fort Peck Reservoir, or $0.35.

The weighted 3-year average for annual expenditures per person per day is $0.33.

Investment Expenditures

The 108 fishermen contacted for expenditure information in 1948 had an average investment expenditure of $0.69 per day, about two-thirds of which ($0.44) was spent for fishing tackle and one-fourth ($0.17) was spent on boats and motors. The remaining $0.08 was spent on camping and other equipment, and trailers.

The 1949 fisherman had a small investment expenditure per day--$0.38. Of this amount, $0.18 was spent for rods and reels, $0.11 for other tackle, and the remaining $0.09 for boats, motors, camp equipment, and similar items.

As indicated above, information on investment expenditures was not collected in the field in 1950. However, using the same reasoning applied to annual expenditure data from the County Survey (op. cit), $0.65 (reduced from $1.30) per person per day should approximate the average investment expenditure for fishermen using the Fort Peck Fishery in 1950.

The weighted 3-year average for investment expenditures per person per day is $0.63.

Total Expenditure

Addition of the weighted averages in the above listed categories provides a weighted average expenditure of $2.78 per person per day for the Fort Peck fisherman. The average total expenditure for 1948, 1949, and 1950 was $3.13, $3.06, and $2.75, respectively. Because of much larger coverage, the 1950 data greatly influences the composite data for the three years.

In comparing the 3 years, it is noted that transportation expenditures are relatively uniform. On the other hand, trip expenditures for 1950 are appreciably lower than those obtained for the previous 2 years. A change in the eating habits of the fishermen, as reflected in the reduction of food and miscellaneous (primarily refreshments) expenditures, largely accounts for the small trip expenditure in 1950. The combined total of annual and investment expenditures, based on the County Survey, are greater than those obtained for either 1948 or 1949 through sampling methods. This difference in annual and investment expenditures may be due to the greater detail and coverage provided in the County Survey sample. Also, the 1949 investment figure included some unidentified equipment.

Non-sampling errors, which can be minimized but not entirely removed, are probably responsible, in part, for the variation in the data for the 3 years. In spite of these and various other difficulties, the total expenditure figures for the three years have only minor variability.

The proportionate share of the average total expenditures for the various catogories illustrate the importance of transportation expenditures when a predominantly local fishery is concerned. Transportation expenditures ($1.42) represent 51 percent of the total (Chart 1).

Evaluation of Fishery

Since much of the variation in total expenditure per person per day as determined for the various years of the study may have been due to differences in technique rather than to differences in actual expenditures, it may be assumed that the average expenditure (weighted)

for the three years when applied to estimates of utilization and yield would be indicative of total value. Therefore, the weighted average total expenditure per person per day, rounded to $2.80 (from $2.78), was used in deriving values set forth below.

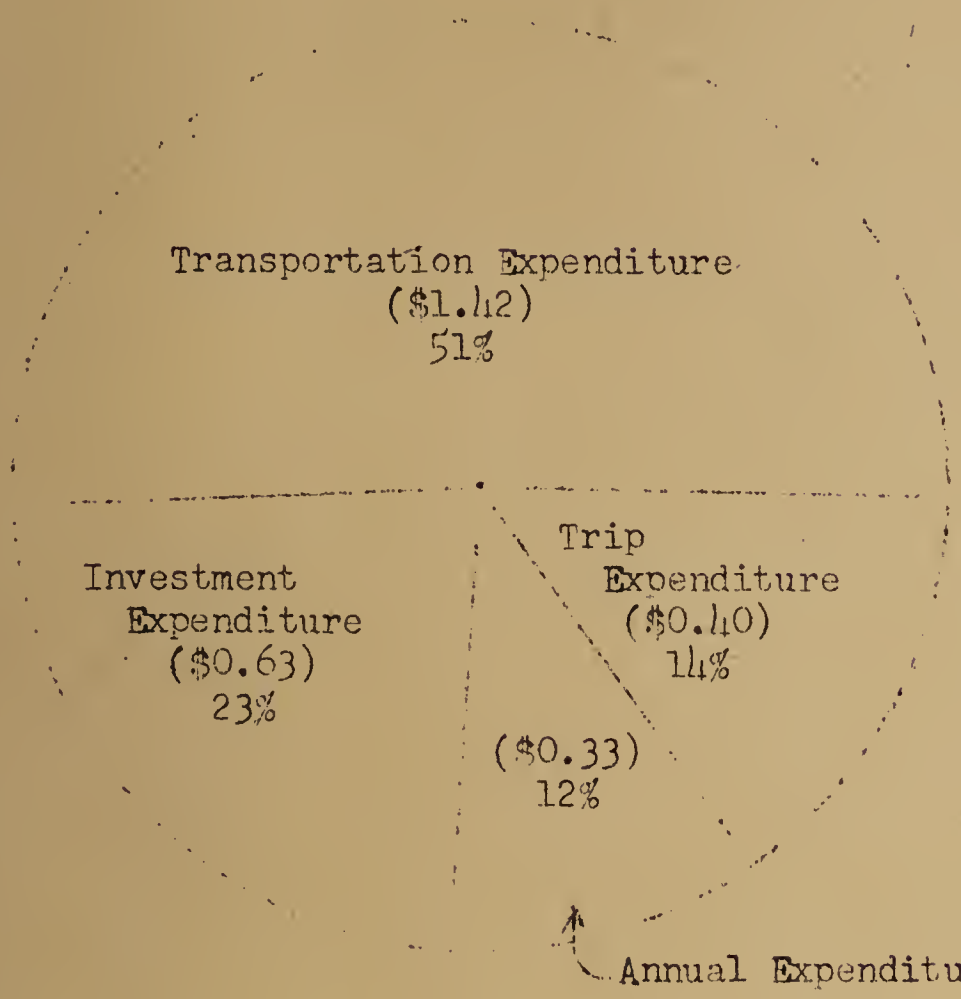

Chart 1. Percentage distribution of component parts of 3-year weighted average daily expenditure for fishermen, Fort Peck Reservoir, Montana, 1948-1950

Applying the expenditure figure of $2.80 to the 3-year average annual utilization in fisherman-days, the total annual value (as reflected by fisherman expenditures) of the Fort Peck Fishery (for both the reservoir and the area below the dam) approximates $68,000. Applying the 3-year average yield in pounds of fish to the total expenditures, it is reasoned that each pound of fish cost the fisherman about $1.60. Values for each of the three years are set forth in Table 12.

Table 12. Total annual value of the fishery and cost per pound of fish, by years, Fort Peck Fishery, Montana, 1948, 1949, and 1950.

Item	1948	1949	1950	3 Year Average
Estimated number of fishermen-days[1/]	25,050	22,050	26,170	24,423
Estimated total expenditure	$70,140	$61,740	$73,276	$68,384
Estimated number of pounds of fish taken	46,230	34,090	47,660	42,660
Average cost per pound of fish taken	$ 1.52	$ 1.81	$1.54	$1.60

1/ It is recognized that there is some duplication in utilization figures derived for Table 12 by addition of totals for the reservoir and the area below the dam, but knowledge of the situation and the relatively short average fishing day of only about 3 hours indicates that exchange of fishermen between the two fisheries in any one fishing day was minimal, therefore consideration of any duplication was disregarded.

Sampling Error

Sampling techniques were employed in the first two years only, consequently, an analysis of sampling error was made for only the first two years. Analysis was confined to the total expenditure per person per day.

For a 19 out of 20 probability, the confidence limits of the total expenditure was $2.57 to $3.69, about a mean of $3.13 in 1948; and in 1949 the limits extended from $2.74 to $3.38, about a mean of $3.06. The average total expenditure in 1950, computed from a complete census, was $2.75 and falls within the confidence limits of both 1948 and 1949.

The difference among total expenditures for 3 years may be due to sampling error in 1948 and 1949.

DISCUSSION

Although goldeye is not a commonly utilized fish at present, there is some indication that this fish is gaining in favor with the anglers who fish at Fort Peck Reservoir. In adjacent Manitoba and Saskatchewan smoked goldeye is held in high esteem. Moreover, goldeye provide excellent sport for the angler who chooses to use light tackle. Since goldeye is one of the most abundant fishes in Fort Peck Reservoir, perhaps here lies a valuable untapped fishery resource. A program designed to point out the attributes of the goldeye could make this fish as popular with Fort Peck anglers as it now is with their northern neighbors.

According to Rounsefell (1930), a reservoir the size of Fort Peck could be expected to produce a commercial yield of about 12 pounds of fish per acre. Thus, the sports yield of 0.17 pounds of fish per acre attained in 1950, which was the greatest yield of the three years, indicates that only a fraction of the potential yield is being realized. Taking into consideration the abundance of carp and goldeye in the reservoir and the potential commercial yield indicated by Rounsefell (1930), it would appear that a properly managed commercial fishery might be feasible without infringing on the present sport fishery.

The available stocking records indicate that approximately one-quarter of a million kokanee (blueback salmon) fry have been stocked in Fort Peck Reservoir since 1941. During the 3-year creel census, however, only three kokanee were checked by the creel census crew, of which only one was positively identified in the laboratory. It seems apparent from the foregoing that kokanee either are not well adapted to Fort Peck Reservoir, or they are unable to compete with the established species.

With recreational development as planned by the Corps of Engineers which includes the construction of boat docks, it is believed that an increase would result in the utilization of the reservoir by boat fishermen.

Carlander (1950), in summarizing the rates of catch per pole-hour for 42 studies of warm water lakes, found that in only 10 of these studies was the rate of catch below 1.0 fish per pole-hour. Compared with the rates of catch for these waters, the rate of catch of 0.77 fish per hour for the 3-year study period at Fort Peck Reservoir is comparatively low. Furthermore, the high percentage of goldeye in the catch resulted in an even lower return to the creel, since this species was seldom retained.

The decline in the number of fishing parties from the town of Fort Peck over the 3-year period was accompanied by a progressive decline in the population of Fort Peck over the same period. This observation aptly illustrates the direct effect that local population and its proximity to the fishery has upon the fishing pressure.

It is also noteworthy that the number of visitor-days at Fort Peck Reservoir increased from 55,350 in 1948 to 101,050 in 1950, an increase of 80 percent.1/ Over the same 3-year period, however, the fisherman-days on the reservoir increased by only 40 percent.

Results of expenditure studies similar to those described for Fort Peck Reservoir have been analyzed for three other warm-water

1/ Visitor-days include the following: sightseers, fishermen, hunters, picknickers, campers, and persons engaged in related outdoor activities. Figures represent entire reservoir area.

fisheries, namely: Ocean Lake in Wyoming (Anonymous 1950a), Lake Maloney in Nebraska (Anonymous 1950b), and the Republican River in Nebraska and Kansas (Anonymous 1952). Some comparisons between results of studies on these waters and the Fort Peck study are shown in Table 13. It will be noted that there is considerable variation in the average expenditure per person per day, whereas the average cost per pound of fish is remarkably similar for the four fisheries. As has been shown in the cited references and preceding sections of this report, the average expenditure per person per day is dependent upon a number of factors. Of these factors, the radius of influence (miles traveled) is the most important, as it in turn affects trip expenditures (for lodging and meals) as shown in Table 12. The average cost per pound of fish is affected not only by the total expenditure per person per day, but also by the rate of catch. The extreme low rate of catch on the Republican River of 0.09 fish per pole-hour (Anonymous 1952) accounts almost wholly for the cited cost of $2.50 per pound of fish on that stream.

Table 13. Comparison of the average expenditure per person per day, and average cost per pound of fish for the Fort Peck Fishery with other warm-water fisheries in the Missouri River Basin

Fishery	Average round-trip mileage	Average expenditure per person per day					Average cost per pound of fish
		Transportation	Trip items	Annual items	Investment items	Total	
Ocean Lake, Wyoming (1947-1949)[1]	68	$4.77	$2.90	$0.43	$1.12	$9.22	$1.28
Lake Maloney, Nebraska (1949-1950)[2]	20	1.41	0.47	0.09	0.45	2.42	1.09
Republican River, Nebraska and Kansas (1951)[3]	15	1.09	0.17	0.09[4]	0.45[4]	1.80	2.50
FORT PECK RESERVOIR, MONTANA (1948-1950)	22	1.42	0.40	0.33	0.63	2.80	1.60

[1] Anonymous, 1950a

[2] Anonymous, 1950b

[3] Anonymous, 1952

[4] Applied from results obtained at Lake Maloney

SUMMARY

1. A creel census was conducted at Fort Peck Reservoir and the area immediately below Fort Peck Dam over a 3-year period, 1948, 1949, and 1950.

2. The average annual utilization in the fisherman-days and yield in numbers and pounds of fish for Fort Peck Reservoir for the 3-year period approximated 17,400 fisherman-days, 49,600 fish, and 28,800 pounds of fish; and for the area below Fort Peck Dam approximated 7,000 fisherman-days, 14,000 fish, and 13,800 pounds of fish. While utilization and yield increased over the 3-year period in the reservoir, these decreased in the area below the dam.

3. During the three years of study, more than half of the total utilization and yield of the reservoir occurred in the area adjacent to Fort Peck Dam, or along approximately 15 miles of shoreline.

4. The three principal species in the catch, in their relative order of occurrence in the catch, were yellow perch, goldeye, and sauger in the reservoir; and sauger, goldeye and yellow perch in the area below the dam. In each instance, the three species constituted about 90 percent of the catch.

5. Combining information from the reservoir and the area below the dam, for a comparable 105-day period of intensive census during the summer of each year, it is shown that (1) utilization increased about 11 percent from 1948 to 1949 and about 27 percent from 1949 to 1950, (2) the number of fish remained virtually the same in 1948 and 1949, and increased only about 8 percent from 1949 to 1950, (3) the average rate of catch per pole-hour declined 0.10 fish per pole-hour from 1948

to 1949 and 0.23 fish per pole-hour from 1949 to 1950, and (4) the average weight of the fish decreased from 0.71 pounds in 1948 to 0.56 pounds in 1949 and increased from 0.56 pounds in 1949 to 0.78 pounds in 1950.

6. The Fort Peck Fishery serves principally local people. Over 80 percent of the people utilizing the fishery came from within a 50-mile radius. Non-resident parties constituted about 3 percent of the total number of parties utilizing the fishery.

7. Based on the assumption that fishermen's expenditures are indicative of the value of a fishery, and the average expenditure per person per day was $2.80, the average annual value of the Fort Peck Fishery is estimated to be about $68,000, and on the average, each pound of fish cost $1.60.

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MRBS 93

Fig. 1. Fort Peck Reservoir at the mouth of the Musselshell River showing flooded timber (Cottonwood) and erodable banks of Bear Paw Shale. June, 1947. (Photograph by L. A. Peterson)

MRBS 997

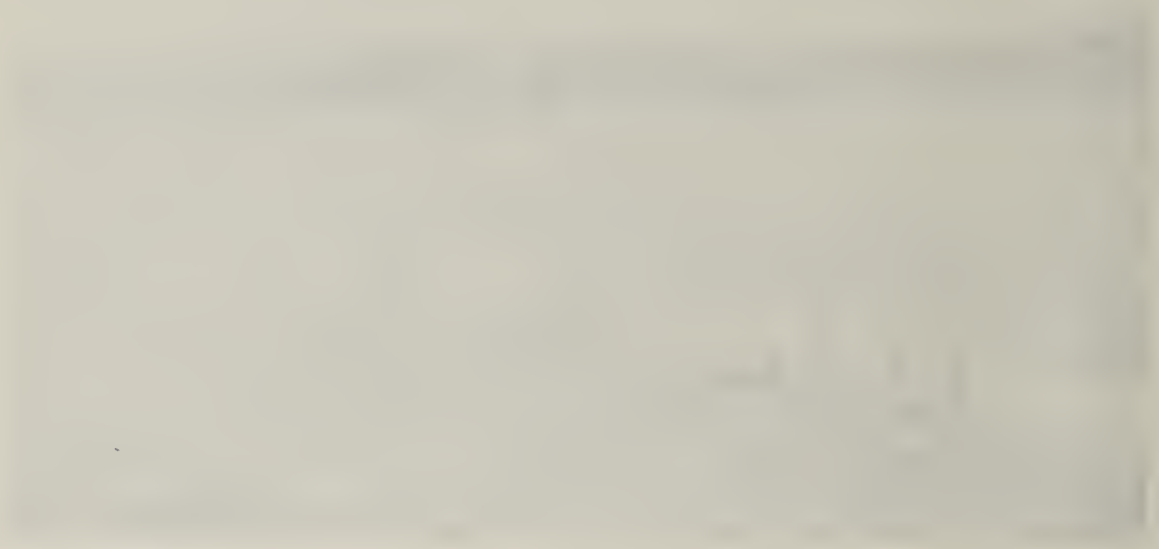
Fig. 2. Member of creel census crew measuring a typical trout (rainbow) taken from Fort Peck Reservoir. August 29, 1948. (Photograph by L. E. Hiner)

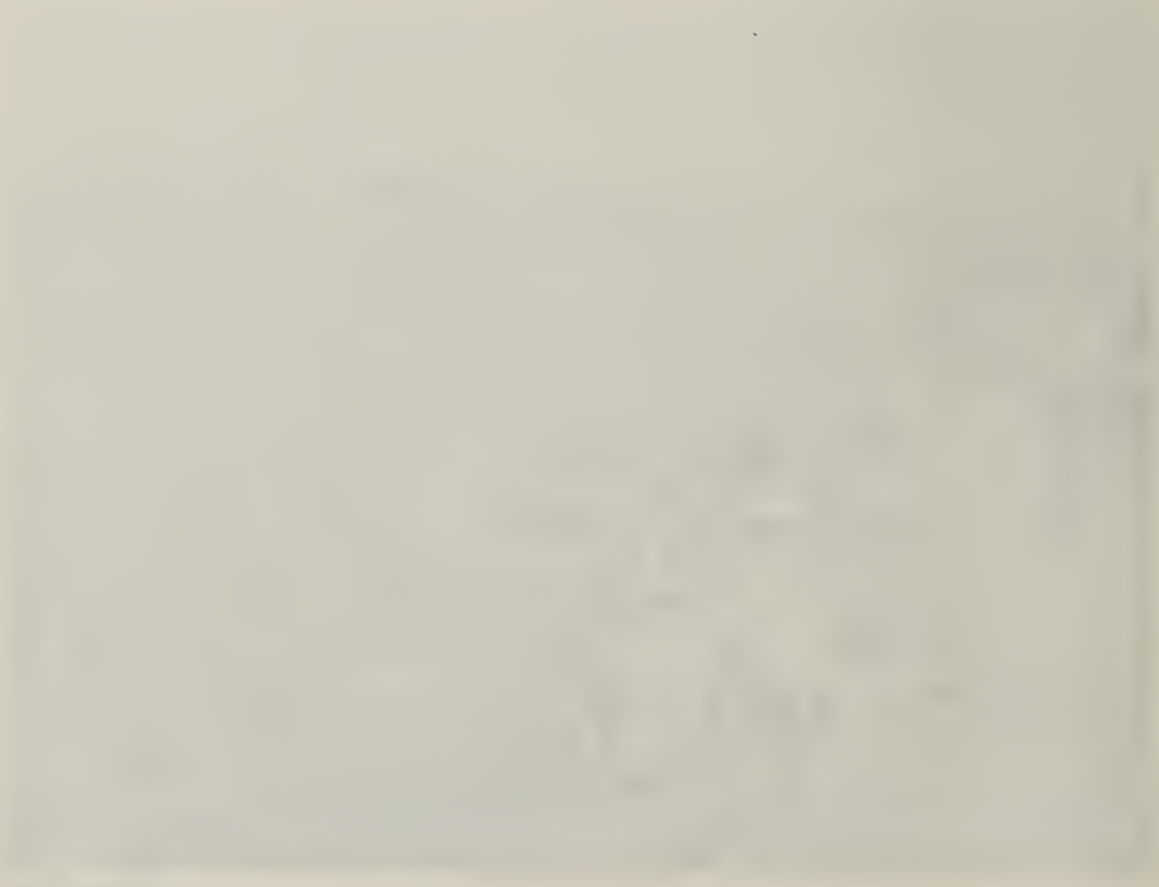
MRBS 2514

Fig. 3. A typical spring afternoon at the Tunnels Area below Fort Peck Dam. Fishermen shown are angling for trout. Note the town of Fort Peck in the background. April 16, 1950. (Photograph by A. J. Nicholson)

MRBS 2145

Fig. 4. A typical summer afternoon at the Upper Spillway Area, Fort Peck Reservoir. Fish shown in foreground are perch. Note the spillway structure in the background. July 31, 1949. (Photograph by H. O. Hanson)





APPENDIX A

Water Analysis, Water Samples Collected by Fish and Wildlife Service
Fort Peck Reservoir, Montana
Analysis by Geological Survey, United States Department of the Interior
(parts per million)

Sample Numbers	6064	7614	7612	7613	M-673	M-674	M-1624	M-2721
Date of Collection	5-31-48	8-7-48	8-19-48	8-19-48	8-5-49	8-28-49	5-16-50	8-21-50
Silica (SiO_2)	13	10	12	11	9.4	11	16	11
Iron (Fe)	0.01	0.02	0.03	0.03	0.02	0.05	0.02	0.04
Calcium (Ca)	56	51	52	64	60	57	57	58
Magnesium (Mg)	21	19	18	21	21	50	21	18
Potassium (k)	72	42	34	53	41	47	55	52
% Sodium	37	31	27	32	28	31	34	34
Bicarbonate (HCO_3)	176	166	168	184	181	183	188	182
Sulfate (SO_4)	192	140	126	190	158	157	173	160
Chloride (Cl)	10	9.0	6.0	8.0	7.5	7.5	8.0	8.5
Fluoride (F)	0.8	0.6	0.4	0.5	0.7	0.7	0.7	0.7
Nitrate (NO_3)	0.5	0.4	0.4	0.0	0.7	0.9	0.9	0.7
Boron (B)	0.15	--	--	--	--	--	0.30	--
Borate (BO_3)	--	--	--	--	--	--	--	--
Zinc (Zn)	--	--	--	--	0.25	Less than 0.05	0	0.06
Dissolved solids:								
Sum - ppm	458	392	372	486	419	405	558	412
Hardness as $CaCO_3$								
Total	226	205	204	246	236	225	229	218
Noncarbonate	82	69	66	95	88	75	75	69
Specific conductance (Micromhos at 25° C.)	666	552	520	660	628	607	636	610
pH	8.0	8.0	8.2	8.1	8.0	8.0	7.9	7.7

KALISPELL
FLATHEAD LAKE
MISSOULA
IDAHO
U.S. HIGHWAYS
STATE HIGHWAYS
GLASGOW
MILK RIVER
Porcupine Cr.
NASHUA
FRAZER
To WOLF POINT
MISSOURI RIVER
LOWER SPILLWAY
BORROW PITS
TUNNEL AREA
UPPER SPILLWAY
POINTS EAST
FORT PECK
FORT PECK AREA
DAM & DIKE
SNOB HILL
DUCK CREEK
BEAR CREEK AREA
Bear Creek
RANGE
THE PINES AREA
ROCK CREEK AREA
S. FK. Rock Cr.
BOX CREEK AREA
McCONE COUNTY
TO CIRCLE
MISSOURI RIVER
FORT
PROPOSED
Woody Creek
Timber Creek
Dry Creek
Little Dry Cr.
FERGUS CO
PE
TO LEWISTOWN AND ROUNDUP
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in Miles
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UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
MISSOURI RIVER BASIN STUDIES
GENERAL LOCATION MAP

FORT PECK RESERVOIR

MISSOURI RIVER
MONTANA

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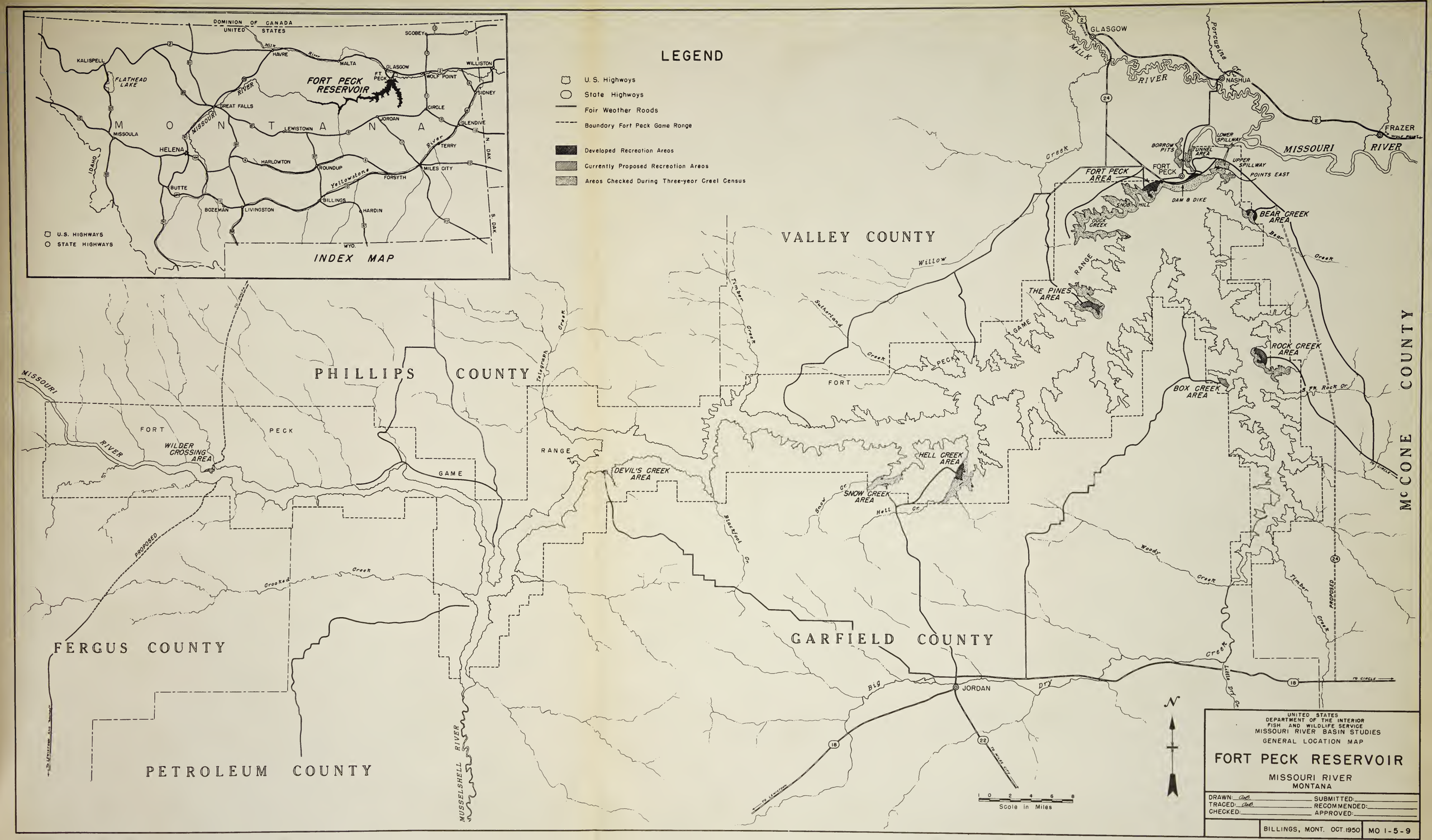
CHECKED: APPROVED:

BILLINGS, MONT. OCT. 1950 | MO 1-5-9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DEVIL'S CREEK AREA
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FERGUS COUNTY
PETROLEUM COUNTY
GARFIELD COUNTY
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